POLYCOPIDAE (OSTRACODA) FROM THE LATE TERTIARY OF THE PORT PHILLIP AND WESTERN PORT BASINS, VICTORIA

MARK THOMAS WARNE

Department of Geology, University of Melbourne, Parkville, Victoria 3052
Present address: Department of Geology, La Trobe University, Bundoora, Victoria 3083

WARNE, M. T., 1990:05:31. Polycopidae (Ostracoda) from the Late Tertiary of the Port Phillip and Western Port Basins, Victoria. *Proceedings of the Royal Society of Victoria* 102(1): 59–66. ISSN 0035-9211.

Six polycopid species have been identified from various Late Tertiary lithologies within the Port Phillip and Western Port Basins. One species, *Polycope sanctacatherinae*, has been previously described; three others, *P. melbournensis*, *P. thomasi* and *P. warneetensis* are described as new. The last has a faint irregular pentagonal network of surface furrows which is an unusual ornament for the Polycopidae. Two further species, *Polycope* sp. A and *Polycopsis*? sp. A are left under open nomenclature.

AS PART of a research program on the Late Tertiary Ostracoda from the Port Phillip and Western Port Basins (Warne 1986, 1987, 1988, 1989), species belonging to the family Polycopidae are here described. Details of the relationship between total ostracod assemblages, palaeoenvironments and facies within the Late Tertiary sequences as well as key first occurrences of ostracod species is presented in Warne (1989).

Comparison of the Miocene and Pliocene faunas from the Port Phillip and Western Port Basins with Late Eocene to Pleistocene ostracod faunas from elsewhere in Victoria (Davies 1985, Guzel 1984, McHenry 1983, Warne 1982, Woodall 1986) indicates that the late Early to early Middle Miocene rocks contain a high diversity of polycopid species. These rocks also yield a high percentage of strongly ornamented forms, suggesting comparatively warm aquatic conditions at the time of deposition (McKenzie & Peypouquet 1984).

MATERIAL AND LOCALITIES

Outcrop samples of approximately 0.5 kg dry weight were collected from the Fyansford Formation in the Batesford Limestone Quarry and at Fossil Beach, Mornington; the Sherwood Formation at Flinders and in boreholes on French Island and near Tyabb, Warneet, Koo-wee-rup and Lang Lang; and from the "Warneet Sands" in Geological Survey of Victoria Sherwood No. 18 bore near Warneet, Western Port. These localities are shown on the maps of Warne (1988, figs 1–3) who also summarised the lithostatigraphy of the region. The localities range in age from late Early Miocene to late Late Miocene or Early Pliocene and yield ostracod faunas belonging to PA1 to PA5 (palaeoenvironmental/age associations of Warne 1987).

Type and figured specimens are housed in the invertebrate palaeontological collections of the Museum of Victoria under the registered numbers NMV P122190–P122201. Other specimens are housed on assemblage slides under the registered numbers NMV P122682–P122763. Locality details for assemblage slides are recorded at the Museum of Victoria.

The abbreviations RV = right valve, LV = left valve, L = length, H = height are used throughout the text.

SYSTEMATIC PALAEONTOLOGY

Subclass OSTRACODA Latreille, 1806
Order MYODOCOPIDA Sars, 1866
Suborder CLADOCOPA Sars, 1866
Family POLYCOPIDAE Sars, 1866

*Remarks.*Chavtur (1977, 1979, 1981) arranged Recent polycopids into sixteen genera based on differences in soft part anatomy, but the relationship between these differences and carapace morphology is unclear. Prior to Chavtur's classification Cainozoic polycopids had been assigned to the four genera *Polycope* Sars, 1866, *Polycopsis* Müller, 1894, *Parapolycope* Klie, 1936 and *Metapolycope* Kornicker & van Morkhoven, 1976. This earlier classification is employed herein although there are also uncertainties with this scheme relating to the significance of carapace morphology. Neale (1983) noted that *Polycope* and *Parapolycope* cannot be distinguished on carapace morphology alone, and considered that the distinction between *Polycope* and *Polycopsis* may not be justified if soft parts are unknown. Polycopid taxonomy

was further complicated by Bonaduce et al. (1980) who included specimens attributed to the type species of *Polycopsis* in *Metapolycope*.

Genus **Polycope** Sars, 1866

Type species. Polycope orbicularis Sars, 1866.

Remarks. The five *Polycope* species described herein fall into two morphological groups. Group 1, which is characterised by narrow inner lamellae, no division of the muscle scars and relatively strongly ornamented carapaces, includes *P. sanctacatherinae* Whatley & Downing, 1983, *P. melbournensis* sp. nov. and *P.* sp. A. Group 2, characterised by broad inner lamellae, division of the posterior and dorsal scars in some specimens and weakly ornamented carapaces, includes *P. thomasi* sp. nov. and *P. warneetensis* sp. nov. Group 2 species also have greater valve overlap in the dorsal region and thicker hinge elements than group 1 species. These two groups show a broad correlation with palaeodepth, group 1 species tending to be more abundant in deeper-water facies than group 2 species (Warne 1987).

Polycope sanctacatherinae Whatley & Downing, 1983

Figs 1A, 2A–D

Polycope sp.—McKenzie 1974: 160, pl. 1, fig. 1.
Polycope sanctacatherinae Whatley & Downing 1983: 387–388, pl. 8, figs 20–21.—Warne 1987: 441, pl. 1, fig. A.

Holotype. Adult RV, OS 121000 from the Fyansford Formation (Middle Miocene, Balcombian) at Fossil Beach, Mornington, Victoria; housed in the Micropalaeontology Section, Department of Geology, University College of Wales, Aberystwyth.

Additional material. One hundred and three disarticulated adult and juvenile valves from the Fyansford and Sherwood Formations.

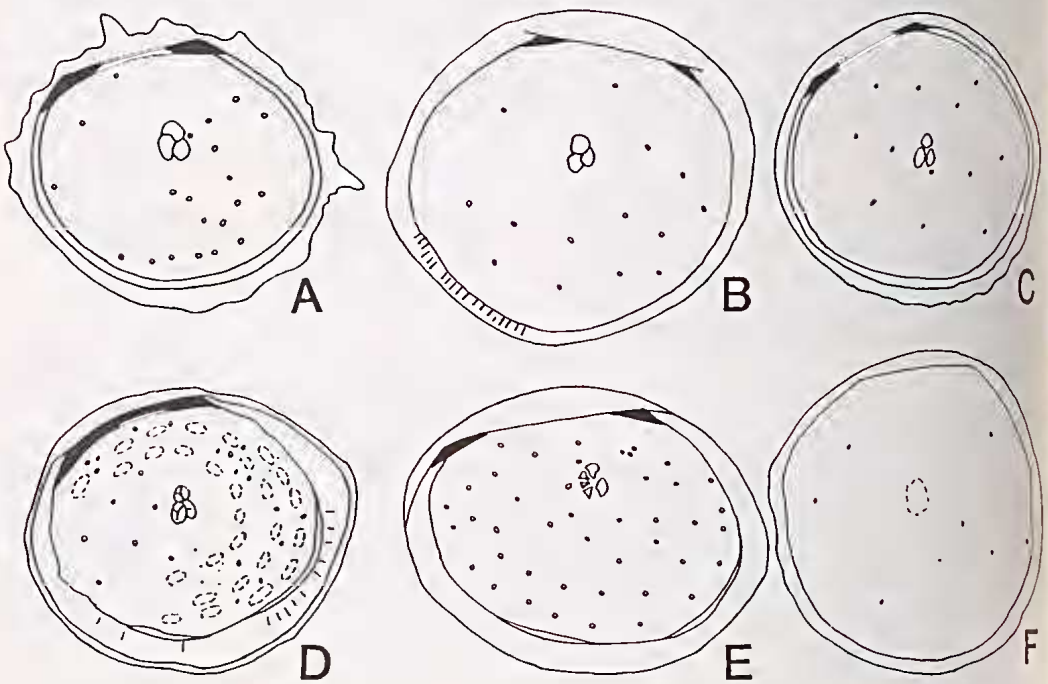

Fig. 1. A, *Polycope sanctacatherinae* Whatley & Downing, 1983, LV internal, NMV P122191, × 122. B, *Polycope melbournensis* sp. nov., RV internal, NMV P122195, paratype, × 90. C, *Polycope* sp. A., LV internal, NMV P122200, × 116. D, *Polycope thomasi* sp. nov., LV internal, NMV P122196, holotype, × 130. E, *Polycope warneetensis* sp. nov., LV internal, NMV P122198, holotype, × 85. F, *Polycopsis?* sp. A., RV internal, NMV P122201, × 81. A–C from Fyansford Formation (Balcombian), Fossil Beach, Mornington; D from Fyansford Formation (Balcombian), Batesford Limestone Quarry; E, F from "Warneet Sands" (Cheltenhamian or Kalimnan), Geological Survey of Victoria Sherwood 18 borehole.

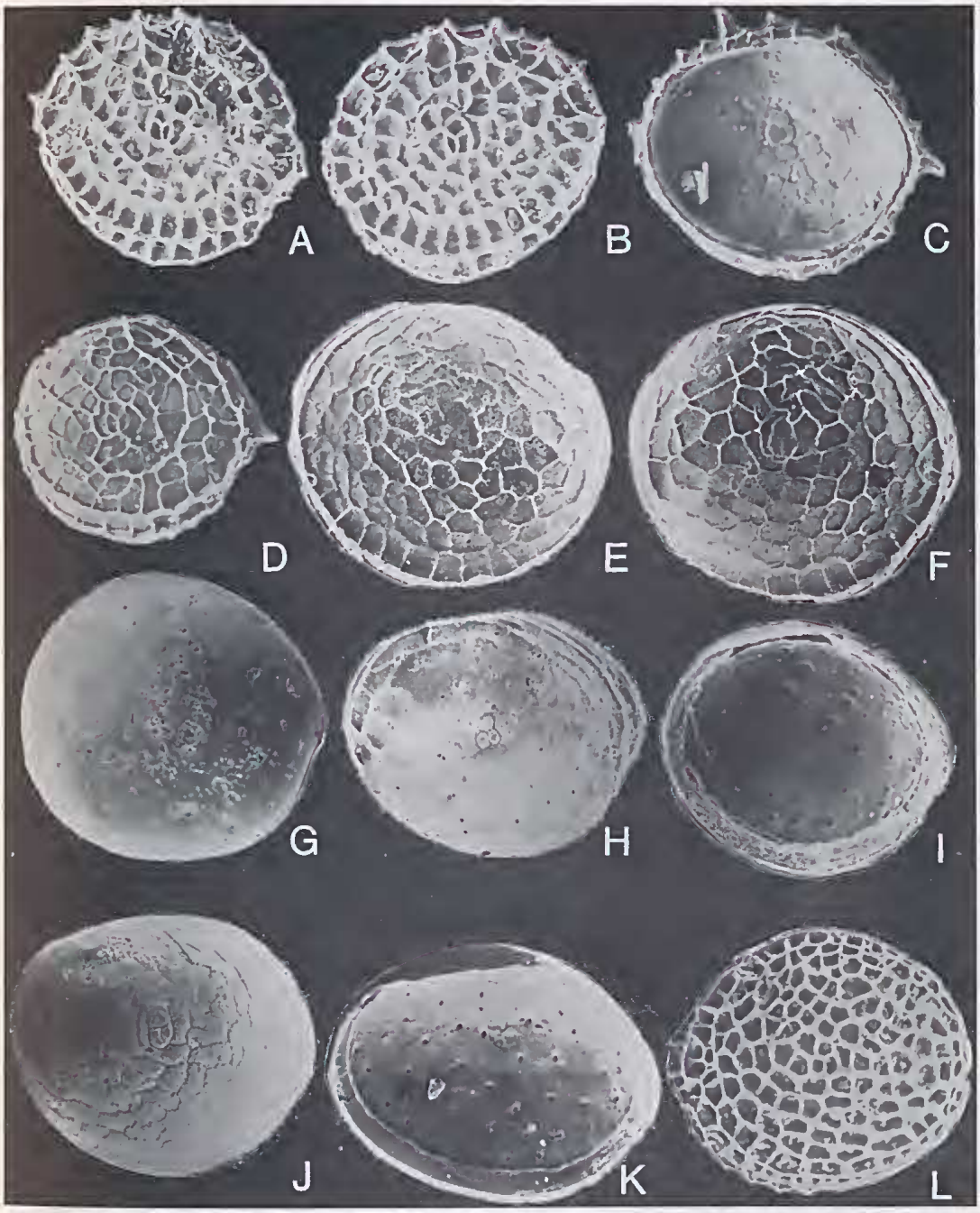

Fig. 2. A–D, *Polycope sanctacatherinae* Whatley & Downing, 1983. A, LV external, NMV P122190, × 117. B, RV external, NMV P122192, × 119. C, LV internal, NMV P122191, × 125. D, RV external, juvenile, NMV P122193, × 175. E, F, *Polycope melbournensis* sp. nov. E, LV external, NMV P122194, holotype, × 85. F, RV external, NMV P122195, paratype, × 94. G, *Polycopsis* sp. A, RV external, NMV P122201, × 78. H, I, *Polycope thomasi* sp. nov. H, RV external, NMV P122197, paratype, × 148. I, LV internal, NMV P122196, holotype, × 138. J, K, *Polycope warneetensis* sp. nov. J, RV external, NMV P122199, paratype, × 78. K, LV internal, NMV P122198, holotype, × 78. L, *Polycope* sp. A, LV external, NMV P122200, × 120. A–F, L from Fyansford Formation (Balcombian), Fossil Beach, Mornington; G, J, K from "Warneet Sands" (Cheltenhamian or Kalimnan), Geological Survey of Vietoria Sherwood 18 borehole; H, I from Fyansford Formation (Baleombian), Batesford Limestone Quarry.

Dimensions. LV, NMV P122190: L = 0.36 mm, H = 0.29 mm; LV, NMV P122191: L = 0.36 mm, H = 0.29 mm; RV, NMV P122192: L = 0.37 mm, H = 0.30; juvenile RV, NMV P122193: L = 0.24 mm, H = 0.19 mm.

Remarks. This species is very similar to *Polycope* sp. 1 Whatley & Downing, 1983 (= *Polycope* sp. 3 Warne, 1987) but there are minor differences in size, ribbing and reticulation. The possibility that the two forms are variants of the one species is not excluded. *Polycope demulderi* Sissingh, 1972 and the species illustrated by Puri & Hulings (1976) as *Polycope? favus* Brady, 1880 (although somewhat different from the illustration of this species in Brady's monograph) are probably closely related forms because of their similar shape and ornamental pattern. Chavtur (1981) tentatively included *P. demulderi* in his genus *Archypolycope* which is, however, defined on soft part anatomy (see discussion of family above).

Age and stratigraphical range. Recorded only from the early Middle Miocene (Balcombian to early Bairnsdalian, foraminiferal zones N8/9–N10/11) clays of the Fyansford and Sherwood Formations.

Polycope melbournensis sp. nov.

Figs 1B, 2E–F

Polycope sp. 1.—Warne 1987: 441, pl. 1, fig. B.
Polycope sp. 5.—Warne 1987: 441.

Etymology. A reference to the city of Melbourne, situated in the northern part of the Port Phillip Basin.

Holotype. Adult LV, NMV P122194 from the Fyansford Formation (Middle Miocene, Balcombian) at mid tide level, Fossil Beach, Mornington, Victoria, approximately 200 m north of end of driveway down to beach; 38°14′S, 145°02′E.

Paratype. Adult RV, NMV P122195.

Additional material. Fifty-one disarticulated adult and juvenile valves from the Fyansford and Sherwood Formations.

Dimensions. Holotype, LV, NMV P122194: L = 0.55 mm, H = 0.46 mm; paratype, RV, NMV P122195: L = 0.52 mm, H = 0.47 mm.

Diagnosis. Carapace moderately large, with loosely ordered reticulum and prominent anterior and anteroventral marginal rib parallel to free margin.

Description. Carapace thin-shelled, inflated posterodorsally. RV larger than LV, both valves more or less circular in shape. RV with a very weakly developed anterior rostrum, not evident in LV. Dorsal margin short, slightly arched in RV, straight in LV; posterior margin of both valves evenly rounded; anterior margin straight in anteroventral region of RV. In dorsal view both valves slightly swollen posteriorly. Maximum length at mid-height; maximum height at mid-length; maximum width slightly posterior to and above mid-height. Low relief ornament covering most of carapace, consisting of pentagonal reticulae on periphery and a distinct anterior and anteroventral marginal rib parallel and close to free margin. Normal pore canals large, simple and scattered. Inner lamellae narrow with inner margin parallel to outer margin. No vestibule visible; marginal pore canals seen in posterior region are numerous and straight. Hinge simple, smooth and adont. A series of small anteroventral denticles present on both valves. Adductors consisting of a cluster of three scars at maximum width of carapace. Sexual dimorphism not conspicuous though some adults are very slightly more inflated than others and these may be females.

Remarks. Differences in the degree of ornamental relief in *P. melbournensis* were originally interpreted by me (Warne, 1987) as indicating the presence of two different species, but these differences seem to be due to either ecophenotypic or taphonomic factors. *P. melbournensis* is similar to *P. reticulata* Müller, 1894 but the latter is slightly different in shape and has a more strongly developed and irregularly shaped reticulum. *P. cancellea* Hartmann, 1954 is smaller and possesses a less evenly rounded lateral outline. *Pseudopolycope intermedia* (Chavtur, 1979) has a more angular dorsal margin and lacks a marginal ridge. *Pseudopolycope krytatcki* (Chavtur, 1977) differs in having a lateral protuberance, whereas *Pseudopolycope comandorica* Chavtur, 1979 is larger and has a more clearly defined rostrum. The similarities between *Polycope melbournensis* and the last three species suggest, however, that the new species may be referred ultimately to *Pseudopolycope.*

Age and stratigraphical range. Specimens range in age from late Early Miocene (Batesfordian, foraminiferal zones N7/8) to late Middle or early Late Miocene (late Bairnsdalian or Mitchellian?), occurring in marls, clays and sands of the Fyansford and Sherwood Formations.

Polycope thomasi sp. nov.

Figs 1D, 2H–I

Polycope. sp. 2.—Warne 1987: 441.

Etymology. In recognition of Dr G. A. Thomas, palaeontologist.

Holotype. Adult LV, NMV P122196 from near the top of the Fyansford Formation (Middle Miocene, Balcombian) in the south- west face of Batesford Limestone Quarry, near Fyansford, Victoria (base of upper quarry bench well above the upper limit of *Lepidocyclina* sp., approximately 25 m above boundary with Batesford Limestone); 38°06′S, 144°17′E.

Paratype. Adult RV, NMV P122197.

Additional material. Seven disarticulated adult and juvenile valves from the Fyansford Formation.

Dimensions. Holotype, LV, NMV P122196: L = 0.32 mm, H = 0.27 mm. Paratype, RV, NMV P122197: L = 0.30 mm, H = 0.26 mm.

Diagnosis. Carapace very small, subrounded, smooth except for faint dorsal and anterodorsal ridges adjacent and parallel to outer margin; series of rounded opaque (patch) patterns evident, dense near free margin but sparser in central and dorsal regions.

Description. Carapace thin. LV slightly larger than RV and overlapping it dorsally; both valves subrounded and produced anterodorsally with a distinct rostrum. Dorsal margin slightly arched in LV, straight in RV. Maximum length at mid-height; maximum height anterior of mid-length; maximum width at mid-length and slightly above mid-height. Surface ornament consisting of faint marginal ribs, most numerous anterodorsally. Faint peripheral reticulate ornament visible, particularly near posterior and ventral margins. Carapace almost smooth centrally. Normal pore canals simple and scattered. Inner lamellae relatively broad with small vestibules developed in ventral region of both valves. Marginal pore canals straight and irregularly spaced. Hinge short and adont, thicker terminally than in mid-section. Very fine anteroventral denticulation. Adductors consisting of three subrounded scars in a subtriangular cluster located slightly below position of maximum width. Sexual dimorphism not detected.

Remarks. A few specimens have divided posterior and dorsal adductor scars. In these specimens the overall pattern consists of up to six individual scars and is reminiscent of that of *Metapolycope* species, though not as complex. *P. thomasi* differs from the other species described here in its smaller size. *P. denticulata* Bonaduce et al., 1980 and *P. parvula* Bonaduce et al., 1980 are similar to *P. thomasi* in size but lack the marginal ribbing and conspicuous anterior rostrum. *P. microdispar* Hartmann, 1954 is smaller than *P. thomasi* and possesses a narrower inner lamellae, whereas *P. arenicola* Hartmann, 1954 is larger and slightly more elongate. *Eupolycope kurilensis* (Chavtur, 1977), *E. pellucida* Chavtur, 1979, *Polycopetta curva* Chavtur, 1979, *Micropolycope angulata* (Chavtur, 1977) and *M. paramushiri* (Chavtur, 1977) all resemble *P. thomasi* in their relatively small size, presence of an anterior rostrum and relatively broad inner lamellae, but have muscle scar patterns consisting of three adductors, except *M. paramushiri* which has a pattern of five scars.

Age and stratigraphical range. Recorded only from the early Middle Miocene (Balcombian, formaniferal zones N8/9) clays near the top of the Fyansford Formation in the Batesford Limestone Quarry.

Polycope warneetensis sp. nov.

Figs 1E, 2J–K

Polycope. sp. 6.—Warne 1987: 441.

Etymology. A reference to the type horizon.

Holotype. Adult LV, NMV P122198 from the "Warneet Sands" (late Late Miocene or Early Pliocene, Cheltenhamian or Kalimnan) in the Geological Survey of Victoria Sherwood 18 borehole, between depths 20 m and 22 m. 38°12′S, 145°16′E.

Paratype. Adult RV, NMV P122199.

Additional material. Nine disarticulated adult and juvenile specimens from the type locality.

Dimensions. Holotype, LV, NMV P122198: L = 0.55 mm, H = 0.44 mm. Paratype, RV, NMV P122199: L = 0.56 mm, H = 0.46 mm.

Diagnosis. Carapace of medium size, oval, with relatively long dorsal margin, a weakly developed anterior rostrum in both valves and a faint irregular pentagonal network of surface furrows.

Description. Carapace moderately thick, almost equivalved except that LV strongly overlaps RV dorsally. Dorsal margin straight, reaching slightly over half maximum length in both valves. Maximum length at mid-height; maximum height anterior to mid-length; maximum width at mid-length and slightly above mid-height. Outline in dorsal view oval. Surface ornament consisting of faint pentagonal network of furrows giving carapace a scaly appearance. Normal pore canals large, simple and scattered. Inner lamellae relatively broad with small vestibules developed in ventral region of both valves. Marginal pore canals not seen. Hinge simple, smooth and adont, thicker terminally than in mid-section. Adductors consisting of three subtriangular to subrounded scars in a tight cluster at position of maximum width. Posterior and dorsal adductor scars divided in some specimens. Sexual dimorphism not detected.

Remarks. This species is distinguished from *P. melbournensis* by its impressed rather than raised ornament and by its distinctly different shape. Specimens of *P. warneetensis* with divided adductors have a similar muscle scar pattern to *Micropolycope paramushiri* (Chavtur, 1977) but are otherwise quite different. I previously (Warne 1987) attributed to this species some poorly preserved juvenile specimens from the Sherwood Formation, but I now consider that these cannot be definitively assigned to *P. warneetensis.*

Age and stratigraphical range. Recorded only from the late Late Miocene or Early Pliocene (Cheltenhamian or Kalimnan) "Warneet Sands" (Warne, 1987).

Polycope sp. A

Figs 1C, 2L

Polycope sp. 4.—Warne 1987: 441.

Material. Five disarticulated adult and juvenile valves from the Fyansford and Sherwood Formations.

Dimensions. LV, NMV P122200: L = 0.38 mm, H = 0.32 mm.

Description. Carapace of medium size, relatively thick-shelled, irregularly rounded and produced anteroventrally. Dorsal margin gently arched. Maximum length slightly below mid-height; maximum height and width at mid-length. Strong reticulate ornament comprising six concentric rows between ventral margin and muscle scar region, not as well ordered elsewhere on carapace. Denticulate anteroventral margin. Hinge short, smooth and adont. Inner margin narrow with no vestibules evident. Adductors consisting of three subrounded scars in a tight subtriangular cluster located at position of maximum width. Normal and marginal pore canals not seen. Sexual dimorphism not detected.

Remarks. This is a distinctive species but adult left and right valves have only been found in separate samples. It differs from *P. sanctacatherinae* in lacking distinct ribbing. The reticulation is coarser than in *P. orbulinaeformis* Breman (tentatively placed in *Archypolycope* by Chavtur, 1981).

Age and stratigraphical range. Recorded only from the early Middle Miocene (Balcombian to early Bairnsdalian, foraminiferal zones N8/9-N10/11) clays of the Fyansford and Sherwood Formations.

Genus **Polycopsis** Müller, 1894

Type species. Polycope compressa Brady & Robertson, 1869.

Polycopsis? sp. A

Figs 1F, 2G

Material. One adult valve from the "Warneet Sands" at the same locality as the types of *Polycope warneetensis.*

Dimensions. RV, NMV P122201: L = 0.55 mm, H = 0.48 mm.

Remarks. The carapace is large, smooth, rounded in lateral view and has a weakly developed anterior rostrum. The species is similar to *Polycope quadridentata* Bonaduce et al., 1975 in shape and in being compressed laterally in dorsal view, but it is larger and lacks marginal denticulation. The adductor muscle scar pattern is obscure, and so the possibility that the species belongs to *Metapolycope* cannot be discounted.

Age and stratigraphical range. Recorded only from the late Late Miocene or Early Pliocene (Cheltenhamian or Kalimnan) "Warneet Sands" (Warne, 1987).

ACKNOWLEDGEMENTS

I thank Drs G. A. Thomas, N. W. Archbold, K. G. McKenzie and I. Yassini for useful discussions and for reviewing early drafts of the manuscript, and Dr A. Cundari for encouragement during various stages of the work. The Museum of Victoria granted access to Chapman's ostracod collection and the Geological Survey of Victoria provided borehole material. Financial assistance from the Commonwealth Postgraduate Research Award Scheme and the University of Melbourne Postgraduate Writing-up Award Scheme is gratefully acknowledged.

REFERENCES

BONADUCE, G., CIAMPO, G. & MASOLI, M., 1975. Distribution of Ostracoda in the Adriatic Sea. *Pubblicazioni della Stazione Zoologica di Napoli* 40 (supplemento): 1–304.

BONADUCE, G., MASOLI, M., MINICHELLI, G. & PUGLIESE, N., 1980. Some new benthic marine ostracod species from the Gulf of Aquaba (Red Sea). *Bollettino Societa Paleontologia Italiana* 19: 143–178.

BRADY, G. S., 1880. Report on the Ostracoda dredged by HMS Challenger during the years 1873–1876. *Report on the Scientific Results of the Voyage of HMS Challenger* 1(3): 1–184.

BRADY, G. S. & ROBERTSON, D., 1869. Notes of a week's dredging in the west of Ireland. *Annals and Magazine of Natural History*, Series 4(3): 353–374.

CHAVTUR, V. G., 1977. Ostracods of the family Polycopidae (Cladocopa) of the Kuril Islands. In *Fauna of the Littoral Zone of the Kuril Islands*, Nauka, Moscow, 144–171 (in Russian).

CHAVTUR, V. G., 1979. New information on ostracods of the family Polycopidae (Ostracoda – Cladocopa) from far-eastern seas. *Akademiya nauk SSSR, Dal'nevostochnyi nauchnyi tsentr, Sbornik rabot Instituta biologii morya* 15: 91–105 (in Russian).

CHAVTUR, V. G., 1981. On the systematic position of the modern Ostracoda in the family Polycopidae (Ostracoda, Cladocopina). *Akademiya nauk SSSR, Trudy Instituta okeanologiya* 115: 53–61 (in Russian with English summary).

DAVIES, C., 1985. Part Two, Palaeoecology of the Browns Creek Clay: Ostracoda. BSc (Honours) report, University of Melbourne, 28–37.

GUZEL, M., 1984. Evolution of the Coast between Goose Lagoon and Killarney, Western Victoria, Australia. BSc (Honours) report, University of Melbourne.

HARTMANN, G., 1954. Neue Polycopidae (Ostracoda: Cladocopa) von europäischen Küsten. *Kieler Meeresforschungen* 10: 84–99.

KLIE, W., 1936. Zur Kenntnis der Ostracodenfamilie Polycopidae. *Zoologische Jahrbücher Abteilung für Systematik* 68: 517–532.

KORNICKER, L. S. & VAN MORKHOVEN, F. P. C. M., 1976. *Metapolycope*, a new genus of bathyal Ostracoda from the Atlantic (suborder Cladocopina). *Smithsonian Contributions to Zoology* 225: 1–29.

LATREILLE, P. A., 1806. *Genera crustaceorum et inseactorum*. Koenig, Paris (4 parts in two volumes).

MCHENRY, B. J., 1983. Section Two, Micropalaeontological Studies (Ostracoda) from the Gelliondale Region. BSc (Honours) report, University of Melbourne, 20–52.

MCKENZIE, K. G., 1974. Cenozoic Ostracoda of southeastern Australia with descriptions of *Hanaiceratina* new genus. *Geoscience and Man* 6: 153–182.

MCKENZIE, K. G. & PEYPOUQUET, J. P., 1984. Oceanic palaeoenvironments of the Miocene Fyansford Formation from Fossil Beach near Mornington, Victoria, interpreted on the basis of Ostracoda. *Alcheringa* 8: 291–303.

MÜLLER, G. W., 1894. Die Ostracoden des Golfes von Neapel und der angrenzenden Meeresabschnitte. *Naples Stazione Zoologica Fauna und Flora des Golfes Neapel Monographie* 31: 1–404.

NEALE, J. W., 1983. Geological History of the Cladocopina. In *Applications of Ostracoda*, R. F. Maddocks, ed., Department of Geosciences, University of Houston, 612–626.

PURI, H. S. & HULINGS, N. C., 1976. Designation of lectotypes of some ostracods from the Challenger Expedition. *Bulletin of the British Museum (Natural History), Zoology* 29: 251–315.

SARS, G. O., 1866. Oversigt of Norges marine ostracoder. *Förhandlinger Videnskabers Selskab Chistiana* 7: 1–130.

SISSINGH, W., 1972. Late Cenozoic Ostracoda of the South Aegean island arc. *Utrecht Micropaleontological Bulletins* 6: 1–187.

WARNE, M. T., 1982. Section Two, Micropalaeontological studies from the Gelliondale region. BSc(Honours) report, University of Melbourne, 19–50.

WARNE, M. T., 1986. *Paranesidea* and *Papillatabairdia* (Ostracoda, Crustacea) from the Miocene of the Port Phillip and Western Port Basins, Victoria, Australia. *Proceedings of the Royal Society of Victoria* 98: 41–48.

WARNE, M. T., 1987. Lithostratigraphical associations of the ostracode fauna in the marine Neogene of the Port Phillip and Western Port Basins, Victoria, southeastern Australia. In *Shallow Tethys 2*, K. G. McKenzie, ed., Balkema, Rotterdam, 435–445.

WARNE, M. T. 1988. *Neonesidea* and *Bairdoppilata* (Ostracoda) from the Miocene of the Port Phillip and Western Port Basins, Victoria, Australia. *Alcheringa* 12: 7–26

WARNE, M. T. 1989. Studies on the Late Tertiary Ostracoda from the Port Phillip and Western Port Basins, Victoria, Australia. PhD thesis, University of Melbourne.

WHATLEY, R. C. & DOWNING, S. E., 1983. Middle Miocene Ostracoda from Victoria, Australia. *Revista Española de Micropaleontologia* 15: 347–407.

WOODALL, M., 1986. Section Two, Palaeoenvironmental Interpretations with Foraminifera and Ostracoda on the Jemmy's Point and Tambo River Formations. BSc (Honours) report, University of Melbourne, 33–67.